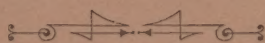


*Sanitary (The) and Fertilizer
Comp'y of the United States &c*

IMPORTANT.

To Municipal Authorities,

Boards of Health, and Others.



HOW TO PREVENT THE

FOULING OF WATER SOURCES

AND THUS OBTAIN

PURE WATER!

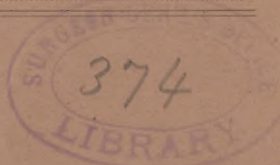
✱ **FREE OF COST,** ✱

AVOIDING

Typhoid Fever, Diphtheria, Cholera,

Dysentery,

And Other Preventable Diseases.



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SANITARY AND FERTILIZER
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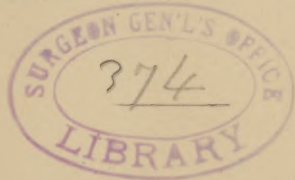
—OF THE—

UNITED STATES.

—
PART I.

SANITARY.

—
PURE AIR TO BREATHE.
PURE WATER TO DRINK.



PHILADELPHIA.

In Three Parts.

PART I. SANITARY.

PART II. FERTILIZER.

PART III. { SANITARY AP-
PLIANCES & METHODS
OF TREATMENT.

THE SANITARY AND FERTILIZER COMPANY.

"It will be safe to infer," says the English Rivers Pollution Commission, "that there is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation."

"It is more than doubtful," says G. V. Poore, M. D., F. R. C. P., "whether there is any absolute safety in obtaining water from deep wells. The Ludlow Lane well, near Liverpool, having a total depth of 443 feet, was fouled by percolation from cesspools, and percolation from a defective sewer would certainly prove equally disastrous."

It is now universally admitted by the best scientific authorities that there is no known filtering process that can free water from germs of typhus fever and other poisons when communicated to it through an infected and putrefactive sewage.

The dejecta of typhoid and cholera patients do not become dangerous to others until putrefaction has set in; and the late Dr. Murchinson, an English scientist of great celebrity, held the opinion that common putrefactive changes taking place in human excrement were a sufficient cause of typhoid, independ-

ent of the admixture of any specific poison. Putrefaction is a great cause of ill health. It was the putrefaction of wounds which once converted our hospitals into something little better than charnal houses, the treatment most in vogue for wounds being "pure" water; but now it is recognized that water is pre-eminently the encourager, and sometimes the main cause of putrefaction, which of all things the surgeon tries to avoid. It is the putrefaction of organic refuse mixed with water in cesspools and sewers that causes that long list of diseases which we ascribe to the inhalation of "sewer air."

Therefore, the shortcomings of modern sanitary methods are due to the fact that in dealing with organic refuse, a scientific error is being committed by mixing excremental matter with water by means of the water-closet and the sewer.

The great object to be aimed at, therefore, is some fixed principle for checking the putrefactive changes in feculent matter, an end attained by appliances and methods owned by this Company, whereby nothing but a clear, inodorous and inorganic water is allowed to pass into the sewer, and from thence into the river, thus preserving the former from putrefactive matter, and consequently the latter from sewage pollution. So that while retaining the benefits and luxuries of the water-closet, it at the same time secures the *two chief necessities of life—pure air to breathe and pure water to drink.*

With the present legalised system the inhabitants of the entire country are employed in fouling the rivers from which all water supplies are drawn. This new course is the very reverse of that which we are now pursuing, wherein each and every individual can be employed without expense to prevent the contamination of our water sources.

The method is in accordance with both the letter and the spirit of a natural law, and the laws of nature are inexorable—

they are not to be set aside by human prayers—not even by that best of all prayers, *labor*.

Not only does the putrifaction of human refuse tend to fill our rivers with foulness, but this mixture of organic matter with water is attended with other bad consequences. It fills the air of our homes and cities with disease. Since the introduction of the present water-closet, and as a direct consequence of it, we have severe epidemics of cholera, a disease not previously known; and enteric or typhoid fever, previously almost or quite unrecognized, has risen to the place of first importance among fevers of this country.

In fact, the evils which have arisen from the water-closet discharging its faecal matters directly into the public sewers are so great and so well recognized that many people high in scientific authority are anxious that we should be compelled, by law, to protect ourselves from the mischief which previous laws have produced.

From a financial point of view, mixing feculent matter with water is not very encouraging to say the least. It increases the water rents, increases the cost of our houses, and puts us to great expense for water. The present treatment of feculent matter before it is finally discharged into our rivers is everywhere an expense, and nowhere a source of profit. It is continually driving us far afield for water, which costs hundreds of millions, and as the growing towns along our water sources multiply and increase, the difficulty of obtaining pure water increases also.

A stupendous plan for supplying the city of Liverpool with water, says the *Sanitary News*, involves the removal of a whole Welsh village, including woods, cottages, churches, etc., this immense space to be devoted to a reservoir is four and one-half miles long by half a mile to a mile broad, and eighty

feet deep. There are to be three lines of pipe, each sixty-eight miles long, with filtering beds and secondary reservoirs; and the cost of the aqueduct alone is estimated at \$15,000,000.

Buenos Ayres is to have a water supply, the cost of the works for which will be fifty million dollars.

By means of great expenditure of time and money, we may wage for a period with nature, a war which may seem apparently successful; but which can never be consummated. The war will never terminate. Nature in the end will assert her eternal sway, and crushing defeat will certainly be our lot.

The only way of securing pure water is to make quite sure that there is no *fouling of water sources*. If this were done, then pure water would be at once plentiful and cheap. It is now very dear, and is getting dearer and scarcer every day.

By placing a simple apparatus, owned by this Company, in every house, each individual will be employed voluntarily, and *without labor or expense on his part*, to do what municipal authorities cannot accomplish even with the expenditure of millions of dollars, *i. e.* PREVENT THE FOULING OF WATER-SOURCES.

The Sanitary and Fertilizer Company.

OPINIONS OF SCIENTISTS.

The Shortcomings of Some Modern Sanitary Methods.

By G. V. POORE, M. D., F. R. C. P.

Being Extracts from the Annual Address delivered to the Sanitary Institute of Great Britain on Thursday, July 14, 1887.

Most of the shortcomings of modern sanitary methods are due to the fact that in our dealing with organic refuse we commit a scientific error, *i.e.*, we pursue a course which is in opposition to natural law.

This error consists in mixing organic refuse with water.

When organic refuse is mixed with water, it undergoes changes which differ widely from the changes which it undergoes when mixed with earth.

In the treatment of putrescible refuse, so that it shall not be a danger or annoyance, what we have to aim at is nitrification rather than putrefaction, and it is certain that by mixing with water putrefaction is encouraged and nitrification delayed.

It certainly seems to be almost incontestible that the proper course to pursue with regard to organic refuse—putrescible matter—is the very reverse of that which we do pursue. We clearly ought to encourage oxidation and make putrefaction impossible.

The putrefaction of organic refuse when mixed with water has, I think, been the chief cause of the development of modern sanitary "progress." Our forefathers were not given to this method of treating putrescible matter. House-slops trickled along open gutters, and excremental matters were deposited in dry pits. At the beginning of this century, the water-closet came into use.

Mr. W. Heywood, quoted by *Dr. Farr*, says: "Water-closets were invented about 1813, and became general in the better class of houses about 1828-33. The custom at first obtained of building cesspools, having overflow drains below their doming, by which means the solid matters were retained, and the supernatant liquid only ran off."

"It will be noticed," says *Dr. Farr*, "that the deaths from cholera and diarrhoea increased in London in 1842, increased still more in 1846, when the potato crop was blighted, and in 1849 culminated in the epidemic of cholera."

Dr. Farr says further, "a system of sewerage is the necessary complement of a water supply."

"Almost coincidently with the first appearance of epidemic cholera, and with the striking increase of diarrhoea in England, was the introduction into general use of the water-closet system, which had the *advantage of carrying night-soil out of the houses*, but the incidental and not necessary disadvantage of *discharging it into the rivers from which the water supply was drawn*."

In the decade 1871-80, 33,168 persons died of diarrhoea in London, the death-rate from this cause being .94.

If the death-rate of 1838 (.215) had obtained in the decade from 1871-89 this cause would have numbered only 7,600, and there would have been a saving of 25,568 lives.

This arises from the fact that much of the organic matter which we mix with water is distinctly poisonous. The zymotic

theory of disease has of late years assumed more definite shape, so that we may now leave what was called the *zymotic theory*, and consider the actual facts of zymosis.

There is no doubt that the actual infective elements of many zymotic maladies consists of microbes, fungoid bodies belonging to the class of fungi, known as schizomycetes, that class which grows in organic mixtures where insufficient free oxygen is present.

These microbes are infinitely small; millions of them may live in a cubic inch of putrefying liquid. Under favorable circumstances they will live for long periods. They will not only live, but multiply, and it is, at least, a question, and a grave one, to what extent these infected germs undergo an increase when mixed with organic liquids.

The fact that the zymotic poisons are *particulate and alive* is one which has most important bearings on the subject under discussion. If the poison were a chemical poison, then dilution would practically do away with its power for harm. No amount of dilution is capable of destroying a zymotic poison; in fact, it is not impossible that the mere mixing of organic refuse which contains a zymotic poison with water may be the means of keeping it alive and possibly cause it to multiply.

When a mass of organic matter charged with zymotic particles is mixed with water and washed out of a house, the water will carry the poison with it wherever it may chance to flow or trickle; to watercourse, well, or any other source of drinking water; in fact, the dissemination is as perfectly and thoroughly done as if dissemination of poison were the main object which we had in view.

When dealing with organic matter impregnated with zymotic poisons, mere dilution with water increases rather than diminishes the danger.

As long as the poisonous organic refuse is concentrated, its repellent qualities are such that there is little chance of its gaining access to the human body. The microbes contained in it are theoretically capable of infecting an almost indefinite quantity of water, and this large quantity of water masks the repellent qualities of the stuff, and thus the danger of infection is greatly increased.

This dissemination of poison by water is one of which we have had very bitter experience in this country. There is little room for doubt, that in this country, at least, water has been the great carrier and disseminator of the poison of cholera.

In 1849 the mortality was highest in those districts getting their water supply from the Thames between Battersea and Waterloo Bridge.

In 1853-54 the same phenomenon was observed. In 1866 the chief mortality was in the district supplied with water taken from the river Lea. With regard to this latter epidemic, we are in possession of many details, and the following is a summary of the facts given by the late Dr. William Farr, in his report on the cholera epidemic of 1866 :

"Several cases of cholera and choleraic diarrhoea had occurred over London in May ; and on June 27, at 12 Priory Street, Bromley, one poor Hedges, a laborer, and his wife, both of the age of 46 years, died of "*Cholera Asiatica*," the former after fifteen and the latter after twelve hours illness. These cases are minutely described by Mr. Radcliff, who traces the discharges into a water-closet of 12 Priory Street, and thence 300 yards down the sewer into the Lea (a tidal river which ebbs and flows) at Bow Bridge, half a mile below the Old Ford reservoirs. He attaches great importance to these first cases, and they undoubtedly sufficed to pour into the sewers and waters millions of zymotic molecules, which day by day grew more and more frequent in the Lea, by every hour's choleraic

discharges on both sides of the river." A few days later water was supplied to the district from a reservoir, the bottom of which was previous to the waters of the Lea, and then resulted an outbreak of cholera and diarrhoea which caused the death of over 4,000 persons.

I need not give further instances of the dissemination of disease by water-carried sewage; sanitary literature is full of them.

What is true of cholera is also true of typhoid, and I will only say in reference to this subject that (if we accept, as we are bound to do, the statements put forward with regard to the cholera epidemic of 1886), if the excreta of the Hedges family had been buried, the waters of the Lea would not have been infected, and possibly 4,000 lives would have been saved.

The first principle in dealing with epidemic disease is that which is expressed in the words *principiis obsta*, resist the beginnings. The object of this is evident, and is well expressed by Shakespear in the words:—

A little fire is quickly trodden out,
Which, being suffered, rivers cannot quench.

The mixing with water may be looked upon certainly not as a resistance of the beginnings, but rather as a nursing and favoring of them, which, "being suffered" most certainly "rivers cannot quench."

The great principle of *principiis obsta* has been most rigidly observed by surgeons in dealing with those forms of blood-poisoning which arise in connection with wounds, and which were known as hospital diseases. To Lister, belongs the credit of recognizing that the great thing to be aimed at was the checking of putrefactive changes in the discharges from the wound, an end which has been attained by adopting what are known as antiseptic precautions in the treatment and dressing

of wounds. A foul wound is look upon as a great source of danger to the patient himself, and formerly the poisons generated in the wound of one patient were carried by sponges and instruments (which, be it remembered, were "*clean*," as far as any indications appreciable to our unaided senses were concerned) to the wounds of others ; and thus it followed that the mortality from what was wrongly spoken of as "hospitalism" was enormous. Now, however, putrefaction in wounds is practically at an end, owing to the use of antiseptics and to an improved appreciation of what cleanliness really means ; and as a result of this, hospitalism has disappeared.

Water-carried sewage so fouled the Thames "between the bridges," that after the bitter experiences of 1854, the in-take of the water companies was moved to a point above the tide-way. Since then the population all along the Thames Valley has enormously increased, and if we who get our drinking water from the Thames escape disease, it can only be regarded as due to a happy accident, and not to the observance of any fixed principle to effectually prevent the fouling of the river. The precious liquid with which I am supplied from the Thames costs me, I think, nearly ten shillings per thousand gallons, and I need not say that I am very careful to have every drop which is used for drinking purposes both boiled and filtered.

If sewage finds its way to a water-course, I have not much faith in the various modes of "treatment" which it undergoes in those establishments which local boards love to erect for this expensive amusement. The addition of chemicals, if in sufficient quantity to destroy living organisms, must make the water still more impotable than before, and can only be of use by making the liquid so utterly nauseous that to drink it would be impossible.

Mere filtration cannot be regarded as any safeguard after the experience of the Lausen typhoid epidemic, in which the poison

of the fever filtered through a mile of earth, which was sufficient to check the passage of particles of wheat flour. Wide irrigation over a large area of land, as is practiced in "sewage farming," is probably the best method of treating sewage.

If antiseptics have been previously added to the sewage, this must increase the difficulties of "farming" with it, as if the antiseptics have been added in sufficient quantity to destroy disease organisms, this would effectually check the growth of those organisms upon which the fertility of the soil depends.

Dr. William Farr said: "A system of sewerage is the necessary complement of a water supply." For myself I should be inclined to say that an extraordinary water supply is the necessary complement of water-carried sewage, because with it our ordinary supplies quickly get fouled. In London we have effectually fouled all our wells, and the state of the Thames is such that a man must be in the very extremities of thirst or else insane before he would drink from the Thames anywhere between Teddington Lock and Gravesend. The state of our noble river is a deep reproach to us, and must remind us day by day of the serious blunders we have committed. As long as it remains as it is we certainly have no claim to be followed as an example in matters sanitary. London should serve as a warning, as did the drunken Helot to the Spartan youth.

It must not be forgotten that pure water is as necessary for animals as it is for man; and that if we persist in fouling our river, the poor farmer may have to pay a "water rate" for providing an artificial water supply for his horses, cattle, sheep, and even poultry. Many diseases of animals are communicable to man; and it is daily becoming more evident that our health is very intimately bound up with the health of our animals, and that their sanitary condition is scarcely less important than our own.

The sewers we have built with borrowed capital. We have seized all the glory and patronage of disbursing enormous sums, and have left posterity to pay the bills. This is a doubtful policy, and, I think, a most immoral one; but I feel it is little use to raise my feeble voice against the custom which is now so much encouraged of hanging a debt round the neck of our successors. It may be defensible to raise a loan for building town-halls, schools, and similar edifices, of which posterity will reap the benefit, but to raise loans for the purpose of wasting most valuable fertilizing matter by means of works which will be a constant expense, and never a source of profit, is a very doubtful expedient.

I hope the custom will soon obtain of compelling each generation to bear the charge of its own sanitary experiments—and blunders.

Causes of Preventable Diseases.

By PEMBERTON DUDLEY, M. D., OF PHILADELPHIA,
MEMBER STATE BOARD OF HEALTH OF PENNSYLVANIA.

In her typhoid fever mortality, this city has a bad record. She also has cesspools. The ground on which she stands is fairly honey-combed with them. They poison the soil beneath our homes, they pollute the air we breathe, they contaminate the water we drink and the food we eat; they hurl disease and death in their most loathsome forms into our circle of loved ones. The privy-vault, even at its very best, in any city or town, and even when very near a rural dwelling, is a dangerous, insufferable, abominable nuisance. There are degraded savage tribes who keep in their huts for long months the putrifying

bodies of their dead ; but how does it accord with our ideas of the intelligence, the taste, the refinement of this age, that the great mass of our people keep, within a few feet of their hearthstones, whole tons and tons of festering, reeking rottenness? Whatever we may do with the sewers, let us—in the name of decency and cleanliness and health and life—let us banish the cesspool.

The sanitary significance of typhoid fever is not over-work ; it is filth. The disease does not essentially mean the result of wear and tear, the hurry and worry of life ; it means filth—filth every time—noisome, reeking, disgusting filth.

BY THE LATE HON. ERASTUS BROOKS, OF NEW YORK,
LATE A MEMBER OF THE NEW YORK STATE BOARD OF HEALTH.

Carefully studied records show that typhus fever is due to a specific poison, often producing disease, conveyed into the human body through the agencies of bad food and polluted air, and, in many places, by bad well water, coming from cesspools and like exposures. Sewer digging is another serious source of evil.

Water used for drinking needs watching, and an analysis, where there is doubt or ignorance of its source or supply, is required. The transmission from wells, brooks, and springs to dwellings also need watching. Even ice, with the pure surface, may be contaminated where the water is not pure. Polluted waters are rarely detected by touch, taste or smell, and only chemical and microscopic examinations can trace the real sources of soil. Surface wells are dangerous and sub-soil wells are undesirable.

Sewerage is another public enemy. Sulphuretted hydrogen and ammonium sulphide are found in our sewers, creating organic fetid vapors; and these, if not wholly decomposed, make them fatally foul. Even one part of these gases to two hundred and fifty of pure water, in the common atmosphere, it is said, will kill a horse, and double the quantity a dog, and only six parts small birds.

Epidemics are to be treated like public enemies, and often they are worse than armed foes because more insidious and often beyond observation. They come in foul sewage, polluted streams and wells of water corrupted by cesspools and closets. They come like a thief in the night and steal away those jewels of the household, the little ones, whose lives are more precious to their owners than all the wealth of the State.

When sewer air poisons the blood and produces diphteria, dysentery, and malaria in other forms, who shall condemn any proper law to prevent poison and self-inflicted murder?

This subject addresses itself to the hearts, minds, bodies and estates of every man and woman in the land. The real wealth of a nation is counted not in the mines of gold and silver, nor in the more useful metals of iron, lead, copper and tin, nor yet in the millions of acres of land cultivated by between five and six millions of our people; nor in the work produced by half this number of persons employed in the manufactories and workshops of the people; nor yet alone in the treasures brought up from the depths of the sea, or borne upon the two oceans which surround us; nor from or upon our grand lakes and large or limited rivers. These are grand and stupendous sources of material wealth and physical greatness. But, as far above them all as the heavens are from the earth, as a simple question of value, is the general health of the people. Here alone is true manhood, real civilization, the source of contented life, peace and rest in the family, pervading

happiness and substantial good will among men. Here alone the personal man is the true temple of the undying soul, and only the purified abodes of men are fitting habitations for this vital principle.

BY THE HON. E. A. WOOD, M. D., OF PITTSBURGH, PA.

The diseases most prevalent in this State are typhoid fever, spinal and scarlet fevers, diphtheria, measles and whooping-cough. They are caused by specific germs, and are all preventable. But to prevent them we must prevent the growth of the germs which cause them, or at least find a way to modify their malignancy.

Disease has too long had malignant sway; let us try the benignant rule of Hygiea. The suffering from preventable diseases and the consequent loss of life must be laid at the people's door, and the only mitigation is in their ignorance. Thousands of graves, too short for humanity, but not too deep for remorse, dot, as with marks of despair, the hillsides of our beloved State. How much keener the remorse, and how much deeper the despair when we are brought face to face with the awful truth that the diseases of children are nearly all preventable. From every churchyard dead children rise up in judgment against us. Go count the short graves in this State, go stand by the tombs of the victims of fever at Plymouth and Shenandoah. Weigh out the tears, the agony, the stricken households, and then weigh out the gold that would prevent such terror, and wail over it like a miser.

This age calls for heroes; not heroes panoplied with sword and shield, and quickened by a fair lady's hand; not the crusader guarding the portals of an apochryphal tomb, but heroes armed with science, and waging war on error.

Men of culture are the knights of the new crusade. They seek no spoils, no selfish chivalry lures them on, no thirst for glory actuates them. Their struggle is for the universal brotherhood of man, their desire to leave the world better than they found it.

State hygiene is the inevitable outcome of a degree of civilization, that degree is now marked on the dial of progress.

BY BENJAMIN LEE, A. M., M. D., PH. D.,

OF PHILADELPHIA, SECRETARY OF THE STATE BOARD OF HEALTH
OF PENNSYLVANIA.

There are large sections of this city in which, during summer storms of the slightest severity, the sewers not only refuse to perform their ordinary duty of carrying off the rain-fall, but vomit forth their stinking contents until the streets are, for squares, flooded knee-deep. What must the effect of pressure be upon the traps of houses on a higher level? I venture to say that there are few houses in the city in which, with a strong south-east wind and a high tide, traps are not forced in the manner indicated.

By Dr. Snively—"Sewers will always be dangerous enemies in our midst, until the sanitary engineers show us how to ventilate them, until this be successfully accomplished, the residents possessing sewer connections, will be compelled, in order to protect their health and lives, to resort to traps. These, in whatever manner constructed, may, under certain circumstances, be unreliable. During a heavy rain-fall, the sewers are filled with water. The gas must therefore be displaced, and as the man-hole covers are tight, and the street-drops, already

trapped, are rendered still more secure at this time, by the floods of water pouring through them, it must of necessity blow out the weaker traps in the house connections and enter the dwelling.

“In cities which drain into the tidewater,” says Mr. EDWARD S. PHILBRICK, in the *Plumber*, “the outfalls of the sewers are generally covered at high water either every day or at spring-tides. If the ends have no gates, the tide enters and fills the sewer as far back as its level allows. If gates exist they shut with the flow of the tide, and sewage accumulates behind them with a result almost exactly similar to what would occur without gates. In either case a large volume of air is driven up from the outfall towards the ramification of the system by every flood tide which covers the mouth of the sewer, only to be drawn back again when the ebb tide allows the sewer to empty itself. If this air does not communicate freely with the outer air, a pressure of several feet of water must necessarily result, alternating the vacuum to the same amount every twelve hours.

Large variations of pressure inside the sewers may also arise from the variable quantity of sewage flowing in them. Nearly all the sewage is discharged from the houses during the hours of daylight, the flow during the night being very small in comparison. Hence a periodic increase and decrease of the amount of air space within the sewers, dependent upon and varying inversely with the amount of sewage flowing. This is particularly noticeable among manufacturing establishments, where much water is used during working hours, and which do not run during the night. Of course, the air must leave the space to make room for the sewage in the morning, and as the flow of sewage diminishes in the evening, the outer air crowds in to fill the vacuum by whatever openings or ducts are most available.

By CHARLES SMART, M. D.,

MAJOR AND SURGEON UNITED STATES ARMY.

The purest natural water is that which has been filtered through a clean soil. The organic matter is reduced to an inorganic condition. It becomes split up into transitional and unstable forms, the changes terminating in the rapid nitrification of a produced ammonia. A water thus purified may yield but little free or albuminoid ammonia on analysis, and even the nitrates that remain to indicate the former sewage pollution, may constitute an apparently trifling quantity; but this water, pure according to the analytical record, may be a dangerous propagator of enteric fever *if the sewage that has been destroyed was an infected sewage.* The purifying influence does not affect the fever-poison, nor does the filtration remove it.

Nevertheless, self-purification, to a certain extent, may be accepted as a fact. Dilution, sedimentation, aeration and nitrification, go on in the current, and all that tend to improve the analytical record of the water; but the chemical testimony which convincingly demonstrates the reality of this self-purification does not demonstrate the safety of the water for drinking purposes.

Dr. Buchanan, of England, summing up the results of a recent investigation, stated that we have no evidence in the case of an unknown water that it is safe organically, although the chemical testimony may place it in the list of waters of extraordinary organic purity; and, practically, the same conclusion was reached by the investigation conducted in this country by Professor Mallet, of the University of Virginia.

Dangerous malarious waters from marshes and other soils rich in vegetable decay leave their noxious constituents behind

them in percolating through the soil, and appear in the well as pure and non-malarious waters. Filtration is therefore capable of removing from a surface water the essence of the remittent fevers that may be present in it.

But we must acknowledge that filtration cannot be trusted to render an *infected water safe*. Hence, the only method by which typhoid, communicated by a general water supply, may be avoided is to procure a supply of water that is free from sewage and preserve it in its condition of natural purity.

To demonstrate that a water which has been polluted by an infected sewage may again become safe for drinking purposes, it is needful to show that typhoid fever is not a prevailing disease among the people who use it. There are many difficulties in the way of effecting this demonstration, and chief among these appears to be the well attested fact that typhoid fever does prevail among them, and in many recorded instances has been traced to the water as its source. Witness the epidemic of last year at Plymouth, or the Lausen epidemic, in which the water underwent a thorough natural filtration before propagating the disease. There is no difficulty in showing that typhoid fever prevails among people who use an infected water; but it is often extremely difficult to prove the charge against the water.

CAUSES OF DIPHTHERIA.—As this is a *preventable and most dangerous disease*, it is of the highest importance that the causes be understood and avoided. The seat is in the throat and is communicated by the breath. It is caused by infinitely small animalculæ, of a most poisonous character, called spores or bacteria, created by *fermentation*. This process of fermentation originates from decaying vegetable and animal matter, from the gas of sewers, cesspools, and vaults, as well as from sinks and filth of all kinds, whether in the air, in the water, or in the ground.—*Anna's of Hygenia*.

KIDNEY DISEASE FROM SEWER GAS.—According to Dr. George Johnson, F. R. S., of London, sewer gas is a frequent source of renal disease, producing albuminuria, with fatal destruction of the kidneys. Dr. Charles S. Wood, of New York, believes in the malaria origin of Bright's disease, and cites a strong array of other authorities in support of his view ; while others hold that malaria is a potent factor, though not by itself an originating cause.—*Anna's of Hygenia*.

ABOUT TWENTY-FIVE THOUSAND DEATHS from typhoid fever occur in this country annually, and this represents fully one hundred and fifty thousand cases of the disease. The hundred and twenty-five thousand persons who recover, lose six weeks out of their lives, and carry perhaps some vestiges of the fever's influence for years.—*Annals of Hygenia*.

NO HOTEL PROPRIETOR can long fill his house without the closest attention to all the sanitary requirements. He may be able, by exterior and surface appearance, to do so for a while, but broken drains, cesspools saturating the soil, foul vaults threatening the water supply with pollution, and like defects, will sooner or later ruin his business. A single outbreak of any of the filth diseases is ruinous, and with neglect it is sure to come.—*Annals of Hygenia*.

Cost of Sickness and Death from Preventable Diseases.

The cost of sickness and death, (says the *Sanitary Era*) that is paid in the United States to save the expense of purifying water, defecating waste, and sanitary policing in general is

estimated, on the low basis of \$750 as the cash value of a life to the community, at not less than \$500,000,000 a year; two hundred millions for more than 250,000 persons slain by *strictly preventable diseases*, and three hundred millions for sickness constantly and necessarily disabling a million and a half at a net loss of at least \$100 a year each, and a direct expense of as much more besides.

If any town would get at its own particular expense for dirt and sanitary neglect, a safe and convenient rule would usually be to compute eight dollars per head of population as a poll tax, if the death rate is a moderate one, say fifteen or ten dollars a head where the average of about eighteen is attained.

During the week, ending June 23d, 1888, there were 801 deaths in New York City, and of this number 537 occurred in tenement houses, while the enormous proportional number of 636 deaths occurred among children under five years of age. The deaths from contagious diseases (deaths that were preventable), amounted to 536.

Dr. Arthur Ransome states that the records of the Friendly Societies of England show an average loss from sickness of 2.45 weeks per annum, for every working man from 21 to 70 years of age. But we have to include in our calculations the less prudent men who are not members of friendly societies, and we may therefore safely assume an average sickness of $2\frac{1}{2}$ working weeks per annum. Taking only the heads of working class families in England and Wales, there are 4,259,259 whose weekly wages will amount to about \$26,000,000; making \$65,000,000 lost in work alone through sickness by the working men. The heads of working class families in Manchester and Salford are 92,593, whose weekly wages amount to about \$100,000 for each day. Thus for every day that sickness can be diminished by the public sanitary measures the authorities of Manchester and Salford will add to the wages of the

working men \$100,000, with 25 per cent. more to the profits of employers and dealers.

Medical men have long been familiar, (says the *Pall Mall Gazette*), with the fact that sanitation has been a saving to the community at large in doctors' bills, in nursing, and even in days of labor to the industrial classes. But it has been difficult to put results into figures so as to impress the public mind. Mr. Brudenell Carter attempted this in his inaugural address to the College of State Medicine. Every case of fever, he calculated, cost the community ten dollars. The reduction in the annual death-rate from fever to 484 per million from the 1851-60 rate of 908 per million represented a total saving of \$1,500,000, "but of this no one seemed conscious;" while the annual cost of scarlet fever at the present time was \$2,000,000 a year.

If there is any doubt as to the amount of money expended for sickness—said A. Arnold Clark, before the Traverse City Sanitary Convention—reflect that there are four thousand doctors in Michigan. They get each year, at least, 1,000 each. Then that means \$4,000,000 which we pay for sickness.

[From *The Philadelphia Press*, Monday, November 19, 1888.]

The City's Sanitary Needs.

EXTRACTS FROM THE REPORT OF DR. LEE TO THE STATE
BOARD OF HEALTH.

In his report to the State Board of Health, **last** Wednesday, Dr. Benjamin Lee, Secretary of the Board, speaks at length on the necessity of stringent protection from cholera, small-pox, typhoid fever, yellow fever and other diseases. He also calls attention to the needs of Philadelphia especially, and notes the deficiencies of the Lazaretto Station. Speaking of the small-pox contagion last spring, arising from the case of an Englishman who came to this country on the steamer Lord Clive, Dr. Lee says: "After a stubborn fight, in which vaccination and disinfection were freely used, but isolation was not insisted upon as vigorously as could have been desired, at the end of eight months the sanitary authorities have, it is hoped, destroyed the contagion, with a record of three hundred and seventy-six cases and a sacrifice of eighty lives. It should also be made a misdemeanor, punishable both by fine and imprisonment, for any individual to suffer from an acute eruptive disease without obtaining the opinion of a respectable physician as to its nature, or for any landlord to harbor such individual, or for any parent to attempt to treat such an acute eruptive disease in a child without obtaining such opinion."

On typhoid fever the report says: "Typhoid fever has prevailed to an unusual extent in the cities of Pittsburg and Philadelphia. As both outbreaks were clearly due to a considerable extent to the character of the drinking water used, the responsibility of the board for urging such State legislation as shall ensure the purity of the water supplies of cities and towns is thereby emphasized. Your Committee on Water Supply has had assigned

to it the duty of preparing a bill for presentation to the next Legislature, which shall, in some measure, remedy the present irresponsible modes of procedure of water companies. Complaints of citizens of Chestnut Hill led to an investigation of the prevalence of this affeciton in the State Hospital for the insane at Norristown, the results of which exonerated the officers of that institution from the suspicion of any disregard of sanitary precautions, and made it evident that typhoid germs could not have reached the Schuylkill from there."

Speaking of the Lazaretto deficiencies, Dr. Lee says: "There are no water-closets or sewers. There is no adequate provision for unloading an infected cargo. The disinfecting chamber is a small wooden building, about ten feet by twelve, in which sulphur fumigation is practised. There is no apparatus for disinfecting by steam. Immediately in front of the station is a wide marsh, into which the establishment drains, and although it is affirmed that malaria does not exist here, it is manifest that the filling in of this spot with the erection of a secure bulk head, preferably of stone, and covering the whole with an impervious coating of asphalt, together with the introduction of a proper system of sewerage, would greatly increase both the salubrity and commodiousness of the institution. Small-pox patients are taken from the steamers at the wharf by the ambulance of the Munincipal Hospital and conveyed through the city to that institution. This plan does not commend itself to the approbation of your committee. The present prevalence of that disease in Philadelphia must be attributed to it. The interests of a city of nearly a million of inhabitants, to say nothing of the many millions of the interior, who look to the authorities for protection, demand that equal vigilance should be maintained during every month of the year."

[From *The New York Herald*, Monday, November 19, 1888.]

This Sickness Doth Infect.

—Henry IV.

BADLY DRAINED MONTROSE, N. J.—SUFFERING FROM TYPHOID FEVER.

Of the many pretty suburban towns on the line of the Morris and Essex Railroad, none has received more attention from wealthy city families, in search of healthy locations, than has Montrose. Situated as it is, on one of the highest peaks of the Orange Mountains, it is in every way calculated to insure that purity of air and soil that are considered indispensable to continued absence of disease.

The occupants of the cottages on the sloping mountain side have been thrown into great perturbation by the discovery that the milk furnished by local dealers is in danger of becoming diseased from the water in the pasture lots in which the cows are kept. Typhoid fever in a malignant form has broken out among several well-to-do families, and one death has already occurred. It is greatly feared others may succumb to the ravages of the malady.

In each case thus far known the cause is directly traceable to the milk furnished by a man whose cows are kept in fields connected with the Mountain House farm, through which flows a stream which has long been noted for its impurities and for the noxious odors it gives forth. Much of the contamination of this water is owing to the lack of drainage at the Mountain House, where the overflow from cesspools empties directly into the stream.

TRACING THE CAUSE.

The owner of the cows which furnished the milk, is Thomas Lyons, a rose grower. It is noticed that every one of the families

to whom Lyon supplies milk, have been stricken with typhoid, and all in the same manner, and he has himself fallen a victim to its ravages, and cannot, it is believed, survive. Among the others stricken are Margaret Brennan and Kate Currie, domestics in the employ of Captain William G. Shackford, two of whose children are also suffering from the disease; one of the children of Sylvester Y. L'Hommedieu, a domestic in the employ of Pay Inspector Edwin Stewart, of the United States Navy, and George Henderson.

Margaret Brennan's illness began on November 5, and she was removed to St. Barnabas' Hospital, in Newark, where she died one week later. Kate Currie is now in the Memorial Hospital at Orange, and has passed the danger point. The others are still very ill, but strong hopes of their recovery are entertained, save in the case of Thomas Lyons, whose cure is almost despaired of by Dr. Mandeville.

BAD DRAINAGE.

Dr. Mandeville told me last night that he had found that the surface drainage of the entire country side tended to the small stream running through the Mountain House farm. He found also that the sewage from that hotel drained into the same stream, filling it with the most impure and dangerous substances. It was from this stream that Lyon's cows were watered, and though the Doctor had never before believed such a thing possible, he was now firmly convinced that the disease had its origin in the milk furnished by these cows.

It was principally through the Doctor's efforts that the South Orange Board of Health were stimulated to action in the matter, and it was only when he had threatened to appeal to the State Board of Health that the local Solons were convinced of the dangers surrounding the town.

Dr. William J. Chandler was also seen, and expressed the gravest fears for the town's health if something were not at once done to check the growth of the disease.

"The whole trouble is owing to the utter lack of drainage in the township," he said. "There is no way in which to carry off the sewage that accumulates, and the inevitable consequence is the outbreak of just such epidemics as these we now have."

THE BOARD OF HEALTH AROUSED.

A special meeting of the Board of Health was held last night, and continued in session till a late hour. Dr. Chandler urged upon them the imperative necessity of adopting a complete system of drainage as the only means of guarding against the spread of the disease. Committees were appointed to investigate the question, and present it in legal form at the earliest possible moment. Reports were received from other parts of the township showing the danger lurking in every part of it from bad drainage.

Prevention of Typhoid Fever.

We have received from the Michigan State Board of Health a circular of six pages, entitled as above, giving practical information in regard to the methods of preventing typhoid fever. The Board advises that immediately on the appearance of this disease, a careful examination should be made of the surroundings of the house, and particularly of the source of water used, to determine, if possible, whether it has been contaminated by leachings from privies or other sources of filth. If the sick person has been at home, and not away where the disease might be contracted, it will be safest that the water used by the sick person immediately before having been taken sick should not be used again for drinking or culinary purposes, unless it is boiled. It is

believed that thorough boiling will destroy the germs or poison of the disease. Ordinary filtering will not do.—*Annals of Hygenia*.

What One Colera Stool May Do.

In a foreign exchange we read that a single cholera stool, gaining access to the source of a large water or milk supply, might presumably decimate a population reckoned by tens of thousands; while the same stool, finding its way into a stagnant sewer, might exhale its poison into a thousand houses, where there is no efficient means of cutting off the invasion of sewer gas. These facts have often enough been pointed out in connection with typhoid, but seem to have been ignored in calculating the prospects of cholera in this country. It is worth while calling attention to them in order to forewarn our sanitary authorities, the profession, and the public.—*Annals of Hygenia*.

PART II.

—FERTILIZER.—

The Inevitable Destiny of Putrescible Matter.

BY G. V. POORE, M. D., F. R. C. P.

Being Extracts from the Annual Address delivered to the Sanitary Institute of Great Britain on Thursday, July 14, 1887.

It may be well to remind you that all dead organic matter is putrescible, and when I speak of putrescible matter I mean all organic matter inclusive of excrement.

Nature moves in a circle, animals feed on each other, and on vegetables, vegetables feed on the dead bodies of animals and vegetables, on the solid and gaseous excrements of animals. Animal and vegetable life are complimentary, and mutually support each other. This is a law of nature, and when I make this assertion I feel I run no risk whatever of being contradicted.

As the inevitable destiny of putrescible matter is to become the food of vegetables—a destiny which we can delay at the most only for a brief period—our proper course in dealing with it is clearly not to attempt to prevent, or even to delay the inevitable. Such a course is to disobey the laws of nature, to fight with her and court ultimate defeat. Our wiser plan is to help nature in her work, and thus win her smiles.

It has been the wise custom in all ages of the world to dispose of the putrescible matter by burial in the earth. Dead bodies have in all ages been buried and the greatest of all law-givers and sanitarians, Moses, whose likeness rightly takes the place of honor in this room, gave most explicit directions that excremental matters should be treated in the same way.

This is a not unimportant fact, and although we do not in this country follow the whole of the Mosaic law, nevertheless that law is so pregnant with marvellous wisdom that we ought not to discard any item of it without first questioning ourselves most strictly as to our reasonableness in so doing. The latest advances of modern science seem to show that in this particular Moses was absolutely in the right.

It has been shown, I think conclusively, that the decomposition of organic matter—whether in the earth, air or water—is brought about by minute fungoid organisms, the growth of which has the effect of resolving the highly complex organic compounds into soluble salts or gaseous bodies, which can be absorbed by the roots of plants.

Now when putrescible matter is buried in the earth it undergoes decomposition without the occurrence of putrefaction—that process which is at once offensive to the senses and dangerous to health. This is effected by means, mainly it is supposed of mould fungi, which produce oxidation of the organic bodies. If sufficient air has access to the pores of the soil, and if sufficient moisture be present, the nitrogen takes oxygen to form nitric acid, which combining with the bases forms soluble nitrates; and the carbon also combining with the oxygen forms carbonic acid, which combining with the bases, forms carbonates.

That the formation of nitrates and carbonic acid from organic matter in earth to which air has access is due to microbes has been proved by direct experiment. When however, organic matter is mixed with earth, and air is admitted in insufficient quantity or entirely excluded, the decomposition is of another kind; and besides small quantities of carbonic acid and carburetted hydrogen, there is formed water, ammonia, free nitrogen, and a great quantity of a black carbonaceous peat-like matter (the so-called sour humus).

There can be no better illustration of the true economy of nature than this action of the microbes in the soil on the conversion of organic matter into soluble salts and gases which serve as food for plants.

The growth of the microbes depends upon the concurrence of those conditions which, by experience, we all know to be favorable to the growth of higher plants. There must be a good supply of free oxygen, sufficient, but not too much moisture and a summer temperature. In ground, broken up so as to admit air to its pores, and in a "fine growing season," in which sunshine alternates with showers, this process of oxidation is at its maximum. The microbes are active beneath the surface manufacturing plant food from organic matter, and the favorable conditions above soil and below cause a vigorous growth of crops.

When on the other hand, the weather is unfavorable, and when, in consequence of excessive cold, excessive drought, or excessive wet, crops are not developed as they should be, the microbial life is also checked, and the change of organic matter is delayed and it is stored up for future use in more favorable seasons. This is the explanation apparently of the fact well known to farmers, that the effect of organic manures is more permanent than that of the so-called artificial manures, which at present are so much in vogue. The organic manure remains entangled in the soil, and is not readily washed out of it in winter when the temperature is low, or even in unpropitious summers. It cannot be washed out until the microbial growth has changed into soluble salts, and when this change takes place, which it does in "good" weather, the roots of the growing plants seize hold of the ever-forming soluble salts and appropriate them to their own use. In fact, the farmer who uses organic manures need trouble himself very little with agricultural chemistry or experiment.

He may feel certain that if he buries his organic manure *directly it is produced* it will not be wasted. It will not give off ammonia to the air, nor will the juices be washed away by rain to the same extent as when it was left above ground to be a nuisance. There seems to be no doubt whatever that all heaps of manurial matter which give off ammonia and other gases to poison the air, and perhaps do more serious mischief which we "know not of," are allowing valuable matter to escape which ought to be undergoing oxidation in the earth. There can be no doubt whatever that to the agriculturalist stink means waste, and it is to be hoped that when his bucolic mind has imbibed this great and important truth the country will be more evenly pleasant than it is. The reason why farmers allow putrescible matter to fester in heaps appears to be:—

1. That the matter has to wait until land is clear and circumstances permit of its being dragged to the fields; and 2,—That when the matter is thoroughly rotten and most offensive a more rapid and visible result is produced, notwithstanding that the total result is probably less than if the matter had been applied to the ground at once. It is certain that putrescible matter intended for manure must waste more above ground than when buried immediately beneath it. Rich farmers are now building sheds over their yards to prevent the access of rain to the manure, and are providing tanks for the reception of liquid which drains away, this involves a very great expense, and it is at least doubtful whether the result is better than that got by the immediate application of such matters to the soil—a process which involves no extra expenditure of any kind—a most important matter, because the only acceptable test of good husbandry is the balance sheet.

Mr. Warrington, F. R. S., in his valuable little book on 'The Chemistry of the Farm,' says: "The most complete return to

the land would be accomplished by manuring it with the excrements of the men and animals consuming the crops."

When chemical manures are used with judgement and applied at the right moment, and when the weather is favorable, there is no doubt that the result is often surprising and gratifying. When, however, the weather is unfavorable, when the drought is so great that the chemicals cannot be dissolved, or when the rain is so heavy that they are washed out of the soil, the result is not encouraging. If organic manures are used, they do not waste in bad seasons, and much remains in the ground for next year's crop. The farmer, however, who applies chemicals in a bad season gets neither crop nor residuum of manure for next year.

In the hands of Lawes and Gilbert farm-yard manure gave better results with barley than with wheat. May not the fact that farm animals are largely fed with barley-meal have something to do with this? There are experiments which show that minimal ingredients in manures are not without effects which are often surprising. There are *a priori* grounds for thinking that the best manure for barley must be the excrement of a barley-eating animal, for in that excrement must be all that is necessary for barley. I wish some agriculturalist would make the experiment of growing wheat with the excrement of a wheat-eating or bead eating animal. As a gardener I have grown potatoes with the excrement of a potato-eating animal, and certainly the result has been most encouraging.

What I want to insist upon is this. that the proper destiny of organic refuse is burial just below the surface of the soil.

Sewers are constant sources of impoverishment to the soil, and the soil, be it remembered, is the only *permanent* and reliable source of wealth in any country. The waste of valuable matter which takes place in London and our big towns must make us blush. I wish the waste were limited to our big

towns, but it is not so. It is common throughout the country, even in rural districts.

If we made a proper use of our organic refuse we should enrich posterity. As it is we reap and we do not sow. If municipalities would bury organic refuse, and plant the seed of some forest tree suited to the soil and situation (which in these days of cheap food, stuffs would probably be the best branch to pursue), they would earn the blessings, instead of the curses, of posterity; and they would beautify the face of nature instead of making it hideous with tall chimneys, pumping stations and precipitating tanks. This piece of advice will, I fear, fall very flat, for of all agricultural arts, forestry seems the deadest in this country.

I have endeavored to show that the admixture of water with putrescible matter is inadmissible.

1. Because it encourages putrefaction and delays nitrification, and is antagonistic to a law of nature, and there can be no successful antagonism to nature.

2. Because the putrefaction set up in cesspools and sewers by mixing water with putrescible matter has been a direct cause of much disease.

3. Because the practice involves the most perfect dissemination of disease particles, and involves a neglect of a great principle, "*principiis obsta.*"

4. Because it is the great cause of the fouling of rivers and wells, and makes the obtaining of pure water increasingly difficult.

5. Because it is financially and economically disastrous, crippling the ratepayers and exhausting the land.



*Further Information and Applications
for Part III can be had by applying to*

JULIUS HIRSHFELD,

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